Mid-Quarter Review

CSE 120 Spring 2017

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Cinco de Mayo: A Major Milestone for Computer Science Education

As many Americans are celebrating the Mexican holiday with food, drink and friends, an estimated 51K high school students will be sitting down to take the first ever Advanced Placement Computer Science Principles (AP-CSP) exam.

The AP-CSP course and exam are the result of nearly ten years of dogged work by hundreds of education advocates, researchers, and high school teachers, as well as investments from the National Science Foundation and industry supporters.

AP-CSP is designed to reflect a wider spectrum of computing fields and appeal to a broader range of students.

- http://www.huffingtonpost.com/entry/59062766e4b05279d4edbd1b

Administrivia

- Assignments:
  - Color Filters due tonight (5/8)
  - Word Guessing due Thursday (5/11)
  - Living Computers Museum Report due Sunday (5/14)
- Midterm & Creativity Assignment grades released
  - + 0.75 points to everyone's midterm scores
- Guest lecture on Friday: Security

Word Guessing

	Array	vs.	String
declare	int[] intAr;		String str;
initialize	intAr = {1,2,3};		str = "hi";
get element	intAr[0]		str.charAt(0)
get length	intAr.length		str.length()

- Learn to use text input & output
  - Player 1 enters a secret phrase
  - Player 2 tries to guess the secret phrase
  - Game tells you how many letters correct & # of attempts

- Strings (*e.g.* `String str = "hello";`) double quotes indicate a string literal (like a word constant)
  - `'c'` is a character, `"c"` is a String, `"cool"` is a String — these are different! — many characters
  - Strings are *sort of* like arrays of characters
    - Can get individual character using `str.charAt(i)`, starting at 0
    - Can get length using `str.length()`
  - Can concatenate using '+' operator
    - *e.g.* `"hello, " + "world!"` gives you `"hello, world!"`

Outline

- **Mid-Quarter Survey Feedback**
- Coding Style
- Programming Tips
- Assignments Review

Lecture

- Polls are too fast
  - Will try to give more time, raise hand to request more time
- Lectures feel rushed, especially at the end
  - My length predictions may be off, sorry :(
- Upload lectures ahead of time
  - by 3am night before
- More coding examples
  - Go over issues with assignments?

Section

- More examples, preferably related to recent lectures
- Handouts for presentation information
- Time management

Reading and Discussions

- Readings are interesting, but discussions are lacking
  - Awkward silences if students don't answer
  - Readings seem long-ish

discussions improve when you participate!

learn from others' experiences & perspectives

- Why is the timing set the way it is?

readings released on Monday → reading check Wed/Thu → discussion Thu → lecture Fri

- TAs will try to expand beyond what is asked in the Reading Checks

- Knowledge is not useful if you can't *apply it*
  - Defend your position, explain to someone else, etc.

Innovation Exploration

- Mini-research project to let you explore a computing topic *that is interesting to you*
  - Pick a recent and relevant topic
  - Think of this as your "project" for the reading & writing portion of this course

- **Part 1:** Innovation Post (5/21)
  - 4+ paragraphs, 550-750 words – posted to Canvas discussion board
  - Well-researched, insightful post, including 3+ citations
  - *Purpose*, *Effects and Impacts*, *Technical Aspects*

- **Part 2:** Respond to Posts (5/26)
  - Comment on 3+ other students' posts

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Why is Style Important?

- Makes code understandable!
  - Functional abstraction relies on well-documented *interfaces*
  - You or others may need to look at your code in the future
    - Fixing things, change in computational problem, forgotten details
- Much of software engineering today is built on top of the work of others
  - Large projects are worked on in groups
  - Most programming languages provide *libraries* of functions for you to use

CSE120: Indentation

- Amount of white space in Processing generally doesn't matter, but proper indentation improves readability
  - Bonus: helps readability when you are debugging

- Anything within a block of code should be indented one level farther in { }
  - *e.g.* function definition, conditional statement, loops
  - As blocks get nested within each other, indentation continues to increase

CSE120: Types of Commenting

- Individual lines of code
  - Off to the right side

```
ellipse(x,y,50,50); //draw ball of size 50
```

- Blocks of code (stuff between {})
  - *e.g.* function definition, conditional statement, loops
  - Because these describe collections of instructions, should be more descriptive of *purpose* and *usage*
  - On line above, at same indentation level

```
// describe the loop's purpose here
for(int i=0; i<3; i=i+1) {
  //do stuff
}
```

- Program block comment
  - At top of program – first thing anyone reads

```
/* filename.pde
   Your Name

   Program description, rules,
   controls, etc.
*/
```

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Programming Reminders

- Programming is commanding an *agent* to achieve a *goal* by giving it *instructions*
  - The agent follows the instructions flawlessly and mindlessly
  - The trick is to find the right instructions to match your *intent*

- Programming requires you to take the agent's point of view
  - Because it is a sequence of instructions, you must account for everything that happened before (*i.e.* trace the program)

Building Blocks of Algorithms

- **Sequencing**
  - The application/execution of each step of an algorithm in the order given

```
fill(255);
rectMode(CORNERS);
rect(-r, -r, 0, r);
ellipse(0, -r/2, r, r);
```

- **Selection**
  - Use of conditional to select which instruction to execute next

which code blocks are executed or skipped?

```
if(mousePressed) {
  fill(0,0,255);
}
```

- **Iteration** (just a condensed form of repetitive instructions)
  - Repeat part of algorithm a specified number of times

```
for(int i=20; i<400; i=i+60) {
  line(i,40,i+60,80);
}
```

really just:
```
line(20,40,80,80);
line(80,40,140,80);
⋮
```

- **Recursion**
  - Algorithm calls itself to help solve the problem on smaller parts

follow function calls
↳ track local variables

Testing

- Manually tracing your code
  - Come up with a set of inputs to test, then follow your program's execution line-by-line to see if the outcome matches what you want

- Trial and Error
  - Unit Test: Test an individual function on a representative set of inputs
  - Integration Test: Run the entire program and see if it behaves as it should ← but where's the error?

- Other methods exist (*e.g.* formal code verification)

Debugging Tips

- "Give a man a fish and you feed him for a day; teach a man to fish and you feed him for a lifetime."
  better to learn to debug than have us debug for you!
- Always start with *simple* examples
  - Easier to trace example through your code
- If doing calculations (*e.g.* arithmetic, loop updates), double-check that you are getting the values that you want
  - Can print values to console or drawing canvas
    - `println()`, `text()`, colors or other drawing clues if you're clever

Debugging Tips

- Don't just randomly tweak things until it works – understanding your errors is always beneficial
  - Correct your own misunderstandings
  - Random tweaks may lead you further away or make your code harder to understand

- Learn to interpret the Processing error messages
  - Some can be Googled, or just ask on Piazza

General Tips

- If you're unsure of *what* something in your code accomplishes or *how*, it's critical that you figure it out
  - Try following the program code instruction-by-instruction
  - Talk to your partner
  - Ask in office hours or on Piazza
  - Comment your code as you go!

we are here to help!

- Functional abstraction is your friend!
  - Use functions to hide away details (combat *monolithic code*)
  - If you find yourself using repeated or similar instructions over and over again, consider rewriting in a function or loop

refactoring

Refactoring

- Despite your best planning, you can't always map out the cleanest solution from the start
  - Often times you'll just start coding and adjust as you go
- Refactoring is the process of restructuring existing code without changing its external behavior
- After refactoring, it's a good idea to go back and test everything again to make sure you didn't break something
  - Good to save a working copy of your code separately before you make major changes

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Jumping Monster

- Main Topics:
  - Functions, program "state", motion

pages variable controlled what we drew (jumping vs. looking)

look variable controlled action

these worked together!

Controlling Elli

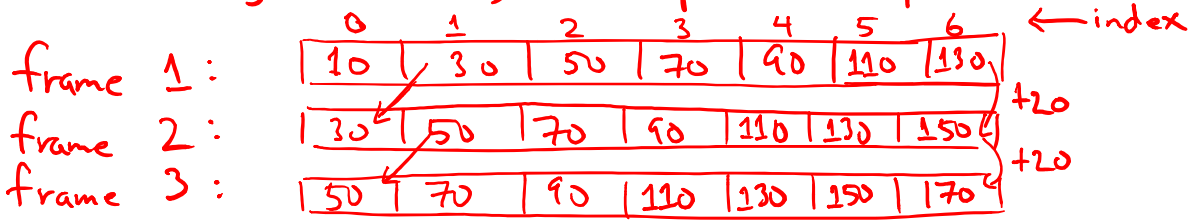
- Main Topics:
  - Arrays, Variables, keyPressed

an array is just a collection of related data

elliX:

x-positions of Elli's body segments

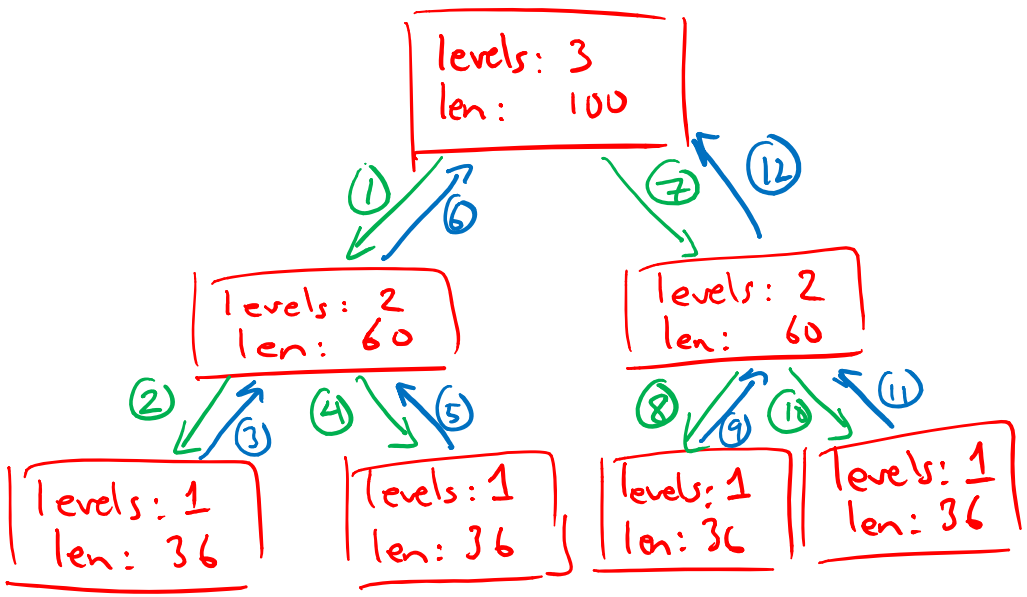
```
//update Elli's body segment positions (excluding the head)
for(int i=0; i< elliX.length-1; i=i+1) {
    elliX[i] = elliX[i+1];
}
elliX[elliX.length-1] = elliX[elliX.length-1] + 20;   //update head position
```



Recursive Tree

- Main Topics:
  - Recursion, Control Flow

follow the function call structure!



— function call
— function return

← base case